

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION  
(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C.20231  
 ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 07 December 1999 (07.12.99)	
International application No. PCT/US99/09779	Applicant's or agent's file reference 60314-036
International filing date (day/month/year) 05 May 1999 (05.05.99)	Priority date (day/month/year) 05 May 1998 (05.05.98)
Applicant MILLINGTON, Jeffrey, A. et al	

1. The designated Office is hereby notified of its election made:

 in the demand filed with the International Preliminary Examining Authority on:

23 November 1999 (23.11.99)

 in a notice effecting later election filed with the International Bureau on:

---

2. The election  was was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	Authorized officer R. Forax  Telephone No.: (41-22) 338.83.38
---	--

REC'D 19 JUN 2000

WIPO

PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference as/am/p10186pc	<b>FOR FURTHER ACTION</b>		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US99/09779	International filing date (day/month/year) 05/05/1999	Priority date (day/month/year) 05/05/1998	
International Patent Classification (IPC) or national classification and IPC G01C21/20			
<p>Applicant MAGELLAN DIS, INC. et al.</p> <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>			

Date of submission of the demand 23/11/1999	Date of completion of this report 15.06.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx. 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Coda, R Telephone No. +49 89 2399 2802



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US99/09779

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1-10 as originally filed

**Claims, No.:**

1-16 as originally filed

**Drawings, sheets:**

1/12-12/12 as originally filed

2. The amendments have resulted in the cancellation of:

the description,      pages:  
 the claims,      Nos.:  
 the drawings,      sheets:

3.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US99/09779

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims 4 - 7, 12, 13
	No: Claims 1 - 3, 8 - 11, 14 - 16
Inventive step (IS)	Yes: Claims
	No: Claims 4 - 7, 12, 13
Industrial applicability (IA)	Yes: Claims 1 - 16
	No: Claims

**2. Citations and explanations**

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US99/09779

**Prior Art**

Reference is made to the following document:

D1: EP-A-0 829 704 (XANAVI INFORMATICS CORP ;HITACHI LTD (JP)) 18  
March 1998 (1998-03-18)

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. The subject-matter of claims 1 to 3, 8 to 11 and 14 to 16 is not new (Art. 33(2) PCT).

1.1 With respect to independent claim 1, the document D1 discloses an information display system for vehicle navigation with the following features:

- a database of locations (see e.g. column 4, line 45, column 6, lines 29 to 31 and column 5, lines 1 to 4);
- a display displaying a plurality of icons, each associated with at least one location in the database (see e.g. column 4, line 23 and column 11, lines 49 to 53 and Figures 2 and 18);
- a user input device selectively activating one of the icons, which is then animated in the display (see e.g. column 12, lines 47 to 55, column 15, lines 41 to 52 and Figures 18 and 21).

Therefore, the subject-matter of claim 1 is not new.

1.2 It is noted that the independent method claim 11 corresponds to independent claim 1 in that for every structural feature of 1 a corresponding method step is defined therein.

Therefore, with respect to document D1 also the subject-matter of independent claim 11 is not new.

1.3 The dependent claims 2, 3, 8 to 10 and 14 to 16 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty, the reasons being as fol-

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US99/09779

lows:

- claims 2 and 15: the features of determining the vehicle position and the route between two positions is disclosed in document D1 (see e.g. column 4, lines 41 to 45 and column 7, lines 30 to 32);
- claims 3 and 14: the use of icons is disclosed in document D1 (see e.g. column 11, lines 49 to 53);
- claim 8: the icon enlargement is disclosed in document D1 (see e.g. column 12, lines 45 and 46);
- claim 9: the use of a text flag is disclosed in document D1 (see e.g. Figure 18);
- claim 10: the icon animation is disclosed in document D1 (see e.g. column 15, lines 41 to 53).
- claim 16: the display of several screens is disclosed in document D1 (see e.g. Figure 6, items 65, 67 and 72).

2. The dependent claims 4 to 7, 12 and 13 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step, Article 33(3) PCT, the reasons being as follows:

- claims 4, 7, 12 and 13: the use of transition files is merely one of several straightforward possibilities from which the skilled person would select, without the exercise of inventive skill, in order to provide the icon animation.
- claim 5 and 6: the use of pixels is merely one of several straightforward possibilities from which the skilled person would select, without the exercise of inventive skill, in order to display an icon.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US99/09779

**Re Item VII**

**Certain defects in the international application**

1. Independent claims 1 and 11 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.
3. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
4. The paragraphs on page 3, line 31, page 7, line 10 and page 10, line 2 "Incorporated by reference", should be brought into accordance with the PCT Guidelines, II-4.18.
5. The last paragraph on page 10, line 27 of the present description, referring to the "Spirit of the invention", should be brought into accordance with the PCT Guidelines, III-4.3a.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/99/09779

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G01C21/20

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G01C G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 829 704 A (XANAVI INFORMATICS CORP ;HITACHI LTD (JP)) 18 March 1998 (1998-03-18) claim 6; figures 1-23	1-3
A	---	4-10
Y	EP 0 478 438 A (SAGEM) 1 April 1992 (1992-04-01) column 6, line 13 - line 30	11
A	---	12-16
Y	US 5 479 602 A (BAECKER RONALD M ET AL) 26 December 1995 (1995-12-26) column 5, line 7 -column 7, line 42	11
A	---	12-16
A	EP 0 704 676 A (PEUGEOT ;CITROEN SA (FR)) 3 April 1996 (1996-04-03) -----	

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

## ° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

28 September 1999

12/10/1999

## Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Crechet, P

## PATENT COOPERATION TREATY



PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>60314-036</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/US 99/ 09779</b>	International filing date (day/month/year) <b>05/05/1999</b>	(Earliest) Priority Date (day/month/year) <b>05/05/1998</b>
Applicant <b>MAGELLAN DIS, INC. et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

contained in the international application in written form.

filed together with the international application in computer readable form.

furnished subsequently to this Authority in written form.

furnished subsequently to this Authority in computer readable form.

the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2.  **Certain claims were found unsearchable** (See Box I).

3.  **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.

the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

as suggested by the applicant.

because the applicant failed to suggest a figure.

because this figure better characterizes the invention.

1

None of the figures.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ 99/09779

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
EP 0829704	A 18-03-1998	JP 10089976 A			10-04-1998
EP 0478438	A 01-04-1992	FR 2667423 A			03-04-1992
		AT 131650 T			15-12-1995
		CA 2052370 A			29-03-1992
		DE 69115417 D			25-01-1996
		DE 69115417 T			30-05-1996
		ES 2080924 T			16-02-1996
		JP 4305684 A			28-10-1992
US 5479602	A 26-12-1995	US 5586237 A			17-12-1996
		GB 2241629 A			04-09-1991
EP 0704676	A 03-04-1996	FR 2725067 A			29-03-1996
		DE 69505769 D			10-12-1998
		DE 69505769 T			06-05-1999



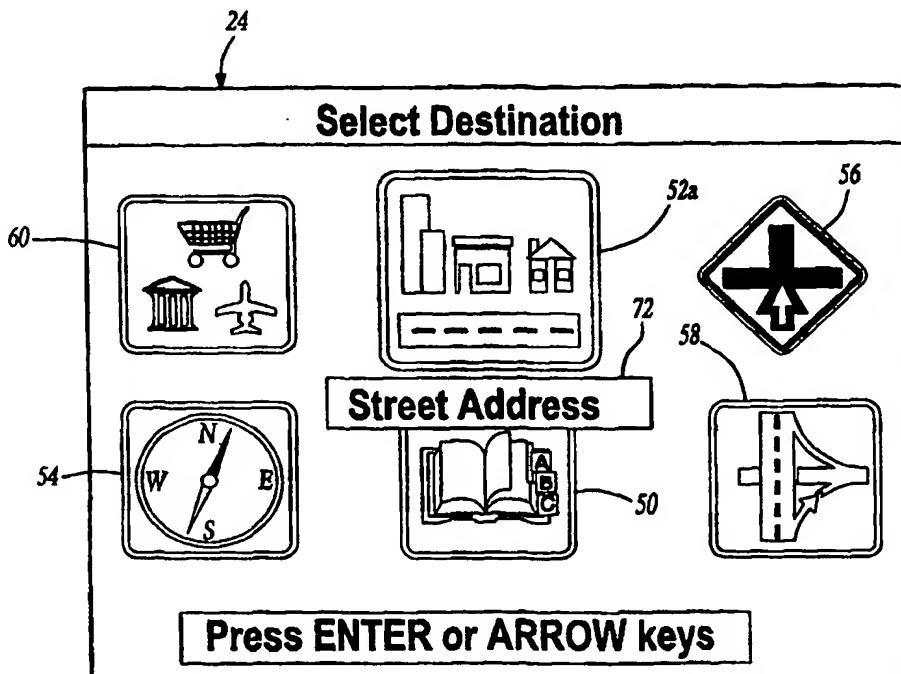
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :	A1	(11) International Publication Number: <b>WO 99/57521</b>
<b>G01C 21/20</b>		(43) International Publication Date: 11 November 1999 (11.11.99)
(21) International Application Number: PCT/US99/09779		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
(22) International Filing Date: 5 May 1999 (05.05.99)		
(30) Priority Data: 60/084,227 5 May 1998 (05.05.98) US 60/084,228 5 May 1998 (05.05.98) US		
(71) Applicant (for all designated States except US): MAGELLAN DIS, INC. [US/US]; 2950 Waterview, Rochester Hills, MI 48309 (US).		
(72) Inventors; and		<b>Published</b>
(75) Inventors/Applicants (for US only): MILLINGTON, Jeffrey, A. [US/US]; 3390 Greenwood Drive, Rochester Hills, MI 48309 (US). MAXWELL, Kenneth, G. [US/US]; 3022 Lindsay Lane, Port Huron, MI 48060 (US). MOUSER, Michael [US/US]; 2451 Clinton Hills Road, Ortonville, MI 48462 (US).		With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
(74) Agents: CARLSON, John, E. et al.; Howard & Howard Attorneys, P.C., Suite 101, 1400 North Woodward Avenue, Bloomfield Hills, MI 48304 (US).		

## (54) Title: NAVIGATION SYSTEM WITH USER INTERFACE

## (57) Abstract

A navigation system that includes a graphic user interface displaying a plurality of icons. An icon selectively activated by a user input device is enlarged, animated, and includes a text flag indicating what the icon represents. Some of the icons are associated with a plurality of potential destinations for the navigation system. The icons are animated by displaying a plurality of frames sequentially. The first frame is a base frame full bit map which includes information for displaying all of the pixels of the icon. The second frame is displayed by changing only the pixels which are different between the first frame and the second frame based upon a transition file which only includes information for the pixels to be changed. A second transition file indicates the pixels to be changed between the second frame and the third frame, and so on. For icons with many potential frames, more than one base frame may be provided, so that any state can be reached more quickly.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

## NAVIGATION SYSTEM WITH USER INTERFACE

### BACKGROUND OF THE INVENTION

5 The present invention relates generally to in-vehicle navigation or "route-guidance" systems and more particularly to an improved graphical user interface for such systems.

10 In-vehicle navigation systems generally comprise motion and position-determining devices, such as GPS receivers, accelerometers, etc. which determine the current position of a vehicle relative to a database of roads. A graphical user interface, typically including a display and user input device, enables the user to select a destination from the database of roads. The display then provides turn-by-turn instructions to the driver guiding the driver to the desired destination from the current position.

15 In some known navigation systems, the graphical user interface provides a hierarchical menu for selecting a desired destination. For example, the driver initially selects from several groups of destinations such as: "intersections," "points of interest," "cities," "street address," etc. After selecting one of the groups of destinations, the user may be provided with another plurality of subgroups of destinations. For example, after selecting 20 "points of interest," the driver may then select from among hotels, grocery stores, theaters, etc.

25 The known navigation system provides text-based menus. The display typically provided in the navigation system is typically three to five inches diagonally; therefore, a graphical user interface which is efficient in both communicating information and receiving input from the driver is desirable.

### SUMMARY OF THE INVENTION

30 The present invention provides a vehicle navigation system having a display including a plurality of icons, each associated with a plurality of potential destinations in a database or other options. A user input device selectively activates one of the plurality of icons. When activated, the

activated icon is enlarged, includes a text flag adjacent the icon, and is animated. Preferably, the animated icon comprises a three or four frame animation. The animation of the activated icon provides an efficient graphical user interface in that the concept with which the icon is associated is more readily perceivable and is reinforced by the animation.

In a preferred embodiment, the animation of the activated icon is provided utilizing at least one base frame and a plurality of transition files. The base file includes all the necessary information for displaying all of the pixels in the icon in a first state. A first transition file contains only that information necessary to transform the icon from the first state to a second state. A second transition file contains only that information necessary to transform the icon from the second state to a third state, and so on.

In an alternative embodiment, the icon may comprise a graphic indicator, such as a compass. The icon includes a plurality of base frames, each comprising all of the information for all of the pixels necessary to represent the icon in each of a plurality of states, which for a compass is preferably the North, South, East and West positions. A plurality of transition files each include information necessary to transform the compass to intermediate states from each of the base frames and to other intermediate states.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above, as well as other advantages of the present invention, will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment when considered in the light of the accompanying drawings in which:

Figure 1A is a schematic of the navigation system of the present invention.

Figures 1-3 illustrate the three sequential frames for animation of the street address icon.

Figures 4-8 illustrate the five sequential frames for animation of the points of interest icon.

Figures 9-10 illustrate the two sequential frames for animation of the freeway entrance/exit icon.

5 Figures 11-13 illustrate the three sequential frames for the animation of the address book icon.

Figures 14-16 illustrate the three frames for animation of the intersection icon.

Figure 17 illustrates an options screen.

10 Figure 18 illustrates a technique for creating the animations of the icons.

Figure 19 illustrates the points of interest screen displayed upon selection of the points of interest icon.

15 Figure 20 illustrates the street address screen displayed upon selection of the street address icon.

Figure 21 illustrates a street address screen displayed subsequent to that shown in Figure 20.

20 Figure 22 illustrates the address book screen displayed upon selection of the address book icon.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

The navigation system 20 of the present invention is shown schematically in Figure 1A. The navigation system 20 includes a CPU 22 having memory 23 (such as RAM) and connected to a display 24, such as a high resolution LCD, LED or other flat panel display. The CPU 22 is also connected to an input device 26 such as a mouse, keyboard, key pad, remote device or microphone. Preferably, the input device 26 is an eight-way directional keypad as described in co-pending application Serial No. 09/037772 entitled "Navigation System with Character Input Device" filed March 10,

25 30 1998, which is assigned to the assignee of the present invention and hereby incorporated by reference. Alternatively, the display 24 can be a touch screen

display. The CPU 22 preferably further includes VRAM 27 for the display 24.

The navigation system 20 further includes a storage device 28, such as a hard drive 28 or CD ROM, connected to the CPU 22. The storage device 5 28 contains a database 29 including a map of all the roads in the area to be traveled by the vehicle 32 as well as the locations of potential destinations, such as addresses, hotels, restaurants, or previously stored locations. The software for the CPU 22, including the graphical user interface, route guidance, operating system, position-determining software, etc may also be 10 stored in storage device 28 or alternatively in ROM or flash memory.

The navigation system 20 preferably includes position and motion determining devices, such as a GPS receiver 34, a gyroscope 36, a compass 38, a wheel speed sensor 40 and a multi-axis accelerometer 42, all connected to the CPU 22 (connections not shown for simplicity). Suitable position and 15 motion determining devices are well known and are commercially available.

As is well known, the position and motion determining devices determine the position of the vehicle 32 relative to the database of roads utilizing dead-reckoning, map-matching, etc. Further, as is known in 20 navigation systems, the user can select a destination relative to the database of roads utilizing the input device 26 and the display 24. The navigation system 20 then calculates and displays a recommended route directing the driver of the vehicle 32 to the desired destination. Preferably, the navigation system 20 displays turn-by-turn instructions on display 24, guiding the driver to the desired destination.

25 Figure 1 illustrates the display 24 of Figure 1A displaying a menu of icons 50-60, from which the user can choose. Each of the icons 52, 56, 58, 60 is associated with a plurality of locations in the database, a method of 30 selecting a destination relative to the database. The icons 50-60 include an address book icon 50, a street address icon 52a (shown activated), off-road navigation icon 54, intersection icon 56, freeway entrance/exit icon 58, and points of interest icon 60. Of course, other icons could also be included or

substituted. The address book icon 50 is associated with a plurality of previously stored destinations that the user has stored and associated with a name or other indicator. Via the street address icon 52 the user enters a street address or the location as the destination. The off-road navigation icon 54 causes the navigation system 20 to enter a navigation mode for off-road navigation. Via the intersection icon 56, the user enters the names of two streets, the intersection of which will be chosen as the destination. If the user selects the freeway entrance/exit icon 58 the user will be prompted to enter the freeway and entrance or exit to be chosen as the destination. The points of interest icon 60 is associated with a plurality of destinations which are grouped by type, such as hotels, restaurants, airports, stores, etc.

Preferably, only one of the icons 50-60 is activated and the remainder are inactive at any one time. In the Figures, the numeral references 50-60 represent inactive icons, while numeral references with letter designations (a-e) represent the respective frames of a corresponding animated icon. As will be described in more detail below, the activated icon becomes animated, enlarged and a text flag is added adjacent the icon, thus distinguishing it from the inactive icons. Preferably, each animated icon 50-60 comprises a three to five frame animation. Further, an audible output of a voice also identifies the currently activated icon. When an activated icon is selected (such as by pressing an "enter" key on the input device 26), the display 24 then displays appropriate subsequent screens, prompting the user to choose from among the locations associated with the activated icons or enter the requested information.

Preferably, the street address icon 52a is activated and animated initially, i.e. prior to any input from input device 26, as shown in Figure 1. Then, using the user input device 26, which is most preferably a directional input device, the other icons 50, 54-60 can be selectively activated. Preferably the user input device 26 is an eight direction keypad. Thus, any one of the icons 50, 54-60 can be activated with a single keystroke.

Figures 1-3 illustrate the three frames 52a-c corresponding to the street address. While the street address icon 52 is activated, it continuously loops

through the three frames 52a-c, while the other icons are not animated. The activated street address icon frames 52a-c are enlarged and larger than the inactive icons 50-60. Further, a text flag 72 is displayed adjacent the activated street address icon frames 52a-c. The animation and enlargement clearly and efficiently communicate to the user which icon has been activated. The animation and text flag 72 also reinforce the association and identity of the associated icon 52.

Figures 4-8 illustrate the first through fifth frames 60a-60e of the animation of the points of interest icon 60. The points of interest icon 60 continuously loops through the five animation frames 60a-e as long as the points of interest icon is activated. The activated points of interest icons 60a-e are enlarged when activated and include a text flag 80 also identifying the icon 60a-e.

Figures 9-10 show the two animated frames 58a-b of the freeway entrance/exit icon 58 and its corresponding text flag 78. Figures 11-13 illustrate the first, second and third frames 50a-c respectively of the address book icon 50 and its text flag 70. Figures 14-16 show the three animated frames 56a-c of the intersection icon 56 and its text flag 76.

The input device 26 includes an "options" button, which when activated causes display 24 to display the options screen shown in Figure 17. The options screen includes a demonstration icon 82, a trip computer icon 83, a configuration icon 84, services directories icon 85, communications icon 86 and diagnostics icon 87. Each of these is preferably enlarged, animated and displayed adjacent a text flag when activated, as described above.

All of the inactive icons 50-60, 82-87 and the first frame of each active icon 50a, 52a, 54a, 56a, 58a, 60a (and any other screen objects) on the display 24 are "pre-rendered" using a 3D modelling program. The bitmaps of the icons are stored in a "C" language header file. To display the inactive icons 50-60 (such as is shown in Figures 1-17) the CPU 22 performs a memory copy from the memory 23 onto the VRAM 27 (Figure 1). Since the objects are pre-rendered, the computation time and the power required are reduced.

Complex rendering, including textures and ray tracing can be utilized without unduly burdening the CPU 22 during run time.

Figure 18 illustrates the technique by which the icons 50-60 in Figures 1-17 are animated, shown by way of example with icons 52a and 52b.

5      Each frame 52a, 52b of the animation is first created as a bit map file which contains all of the information, on a pixel-by-pixel basis, for displaying all of the pixels in that frame. Each frame is preferably anti-aliased; a suitable technique is described in co-pending application Serial No. 09/160,068, filed September 24, 1998, entitled Navigation System With Anti-Alias Map Display, 10 which is hereby incorporated by reference. Then, a computer 90 programmed to operate according to the flow chart in Figure 18 compares each pixel 92a in the frame 52a with the corresponding pixel 92b (at the same x-y position) in frame 52b in step 94. If the pixel 92 is the same in both frames 52a-b, *i.e.*, the pixel 92 is not changed from one frame 52a-b to the next, the software 15 does not save information relating to that pixel 92 and increments to the next pixel in step 96. If, and only if, the pixel 92 changes in the two consecutive frames 52a, b, then the information indicating how to display that pixel in the second frame 52b saved in step 98. In other words, the only information saved is for the pixels 92 that need to be changed in order to transition from 20 the first frame 52a to the second frame 52b. The pixels 92 that are changed are stored in a transition file 100 which indicates the pixel 92 position (x, y) and the color index to which the pixel is changed. The first frame 52a of the animation (or "base frame"), is a complete bit map indicating how to display 25 all of the pixels in the icon 52a. Information indicating how to change the base frame 52a to the second frame 52b is stored as the transition file 100 and includes only information indicating how to display any pixels 92 that have changed between the base frame 52a and the second frame 52b. Another transition file indicates how to change any pixels from the second frame 52b to the third frame 52c, and so on. It should be noted that the computer 90 30 which converts the full bit map files to the transition files 100 is preferably run apart from the navigation system 20. The full bit maps, other than the first

frame, are not stored on the navigation system 20. Identical techniques are followed for the other animated icons.

In the navigation system 20 (Figure 1A), to animate the icon 52 the CPU 22 performs a memory copy from the memory 23 onto the VRAM 27 of the base frame 52a as shown in Figure 1. The CPU 22 then modifies only the pixels in the VRAM 27 as indicated by the first transition file 100 to produce the second frame 52b of the street address icon 52 as shown in Figure 2. The CPU 22 then modifies the pixels in the VRAM 27 according to a second transition file to produce the third frame 52c of the street address icon 52 as shown in Figure 3. The CPU 22 then modifies the pixels in the VRAM 27 according to a third transition file to return to the street address icon 52a as shown in Figure 1. Alternatively, the base frame 52a can be completely reloaded. The CPU 22 and display 24 continue to loop through the frames 52a-c until either the street address icon 52 is selected or another icon is activated.

Upon selection of the off-road navigation icon 54 (e.g. Figure 1), this same animation technique is preferably used to display a compass (not shown) similar to the off-road navigation icon 54. The compass includes an arrow which is displayable at any one of numerous (up to 360) different rotational positions. The compass preferably includes a plurality of base frames, preferably four, one base frame each of the arrow pointing North, South, East and West. Transition files contain only information indicating how to change the compass from a base frame to an adjacent frame (i.e. an adjacent rotational position of the arrow). If a rapid large change is required, a new base frame closer to the frame to be displayed can be loaded. For example, if the compass is currently displayed with the arrow pointing due North and a change to Southeast is required, the East base frame is loaded, followed by execution of several transition files until Southeast is achieved. Utilization of more than one base frame could also be used for displaying other gauges, such as tachometers.

Figure 19 illustrates the points of interest screen displayed on screen 24 after selection of the points of interest icon 60a-e (Figures 4-8). In the points of interest screen, a thumbnail POI icon 104 is displayed in the upper left hand corner of the screen. The thumbnail POI icon 104 reminds the user what screen is currently displayed and further reinforces the association of the points of interest icon 60. The points of interest screen also lists a plurality of points of interest types 106a-f, any of which can be selected using the user input device 26 (Figure 1a). As is known, upon selection of any of the points of interest types 106, a screen listing points of interest of that type are then displayed on display 24. As is known, the user can then select a specific point of interest as a destination for a route for which the navigation system 20 provides turn by turn instructions.

Figure 20 shows the street address screen displayed on display 24 upon selection of the street address icon 52a-c (Figures 1-3). A thumbnail street address icon 107 (preferably an identical, smaller version of the inactivated street address icon 52, such as in Figure 4) is displayed in the upper left hand corner of the screen. The thumbnail street address icon 107 reminds the user which screen is displayed and further reinforces the association of the thumbnail street address icon 107, and consequently the street address icon 52 and 52a-c (Figures 1-17). Generally, to enter a destination in this mode, the user first enters a city and/or state, followed by a street address in the text field 108 by selecting the character buttons 110. Preferably, the input device 26 is an eight-way cursor pad. Initially, the "okay" icon 112 is activated. Upon the first entry from the eight-way directional input device 26, a corresponding center character 116 ("E", "N", "W", "5" or [space]) is activated. The activated character can be selected pressing an "enter" button on the input device 26. Another character immediately surrounding the center character can be activated utilizing the directional input device 26. This is described in more detail in co-pending application U.S. 09/037,772 entitled "Navigation System with Character Input Device" filed March 10, 1998,

which is assigned to the assignee of the present invention and hereby incorporated by reference.

If necessary, the user can select a state or city for the street address by selecting the select state icon 120 and/or select city icon 122 shown in Figure 21. In Figure 21, the select city icon 122 is shown activated and enlarged with the adjacent text flag 124.

Figure 22 illustrates the address book screen including a thumbnail address book icon 130 in the upper left corner of the display 24. The address book screen contains previously stored names and addresses 132 which the user can scroll through or select or enter using the input device 26. The user can then select to be routed to the associated destination.

Preferably, the navigation system 20 permits the user to change the color themes of the display 24 to match or coordinate with the interior of the vehicle. Preferably, the user can select the color themes and other options utilizing radio buttons or check boxes on the display 24.

The intensity or brightness of the display is preferably automatically adjusted based upon the time of day, time of the year and geographical location, all of which can be determined by the GPS receiver. The GPS receiver receives time of day and time of year information from the GPS satellites. The GPS receiver and the other positions determining sensors as well as the map matching and other position determining software determine the geographic location of the vehicle 32. Based upon this information, the navigation system can determine the expected ambient light and adjust the brightness and intensity of the display 24 appropriately, i.e. increasing the brightness and intensity of the display 24 during the day and decreasing the brightness and intensity of the display 24 at night.

In accordance with the provisions of the patent statutes and jurisprudence, exemplary configurations described above are considered to represent a preferred embodiment of the invention. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

CLAIMS

## WHAT IS CLAIMED IS:

1. A vehicle navigation system comprising:

5                   a database of locations;  
                  a display displaying a plurality of icons, each associated with at least  
                  one of said locations in said database; and  
                  a user input device selectively activating one of said plurality of icons,  
                  said display animating said activated icon in response to selection of the  
10                  activated icon by the user input device.

2. The vehicle navigation system of Claim 1 further including

15                  a system for determining the position of the vehicle relative to said  
                  database;  
                  said user input device selecting a desired destination relative to said  
                  database;  
                  a system for determining a route from said database between a position  
                  of the vehicle to said desired destination.

20                  3. The vehicle navigation system of Claim 1 wherein each said icon is  
                  associated with a group of locations in said database, said user input device  
                  selecting a desired destination from among said locations associated with said  
                  group associated with said activated icon.

25                  4. The vehicle navigation system of Claim 1 further including:

                  a base frame comprising information for displaying a first icon of said  
                  plurality of icons;  
                  at least one transition file comprising information for changing the  
                  display of said first icon, said display first displaying said first icon based  
30                  upon said base frame and subsequently changing said display of said first icon

based upon said at least one transition file to provide animation of the first icon.

5. The vehicle navigation system of Claim 4 wherein said first icon at includes a plurality of pixels, said base frame including information for displaying all of said plurality of pixels, said transition file comprising information for displaying only a subset of said plurality of pixels less than all of said plurality of pixels.
10. 6. The vehicle navigation system of Claim 5 further including a plurality of base frames, each including different information for displaying all of said pixels for said icon.
15. 7. The vehicle navigation system of Claim 5 further including a plurality of said transition files, each including information for modifying said display from one state to another incremental state.
20. 8. The vehicle navigation system of Claim 1 wherein the display enlarges the activated icon in response to the activation of the activated icon by the user input device.
25. 9. The vehicle navigation system of Claim 1 further including a text flag displayed on the display next to the animated icon in response to the activation of the activated icon by the user input device, the text flag indicating the locations in the database with which said animated icon is associated.
10. 10. The vehicle navigation system of Claim 1 wherein said activated icon is animated by said display displaying a plurality of frames of said activated icon.
30. 11. A method for operating a graphical user interface in a vehicle navigation system including the steps of:

- a) displaying a plurality of icons on a display;
- b) animating at least one of the plurality of icons on the display;
- c) selecting at least one of the animated icons.

5 12. The method of Claim 11 further including the steps of:

- d) displaying said icon based upon a base frame comprising information for displaying said plurality of pixels;
- e) changing said display of said icon based upon a transition file comprising information for displaying a subset of said plurality of pixels, less than all of said plurality of pixels.

10 13. The method of claim 12 further including the steps of:

- f) in said step b), displaying a first frame comprising said base frame;
- g) after said step f), displaying a second frame comprising said base frame as modified according to said transition file.

15 14. The method of Claim 13 further including the steps of:

associating each of said plurality of icons with at least one destination;  
and

20 selecting a destination associated with said at least one of the animated icons selected in said step c).

15. The method of Claim 11 further including the steps of:

determining a current position;

25 selecting said at least one of said plurality of icons animated in said step b);

selecting a desired destination associated with said at least one of said plurality of icons; and

30 determining a route from said current position to said desired destination.

16. The method of Claim 11 further including the steps of:
  - d) displaying an associated screen in response to said step c);
  - e) displaying a smaller version of the at least one icon on the associated screen.

1/12

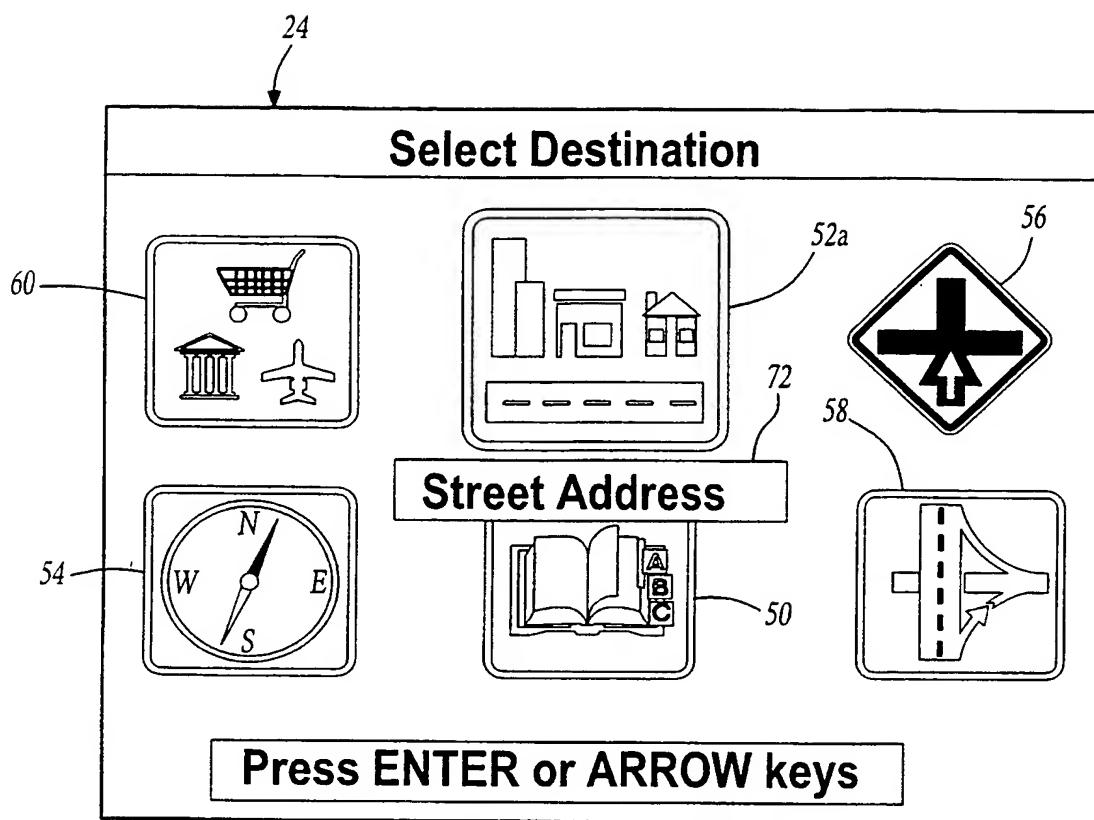


Fig - 1

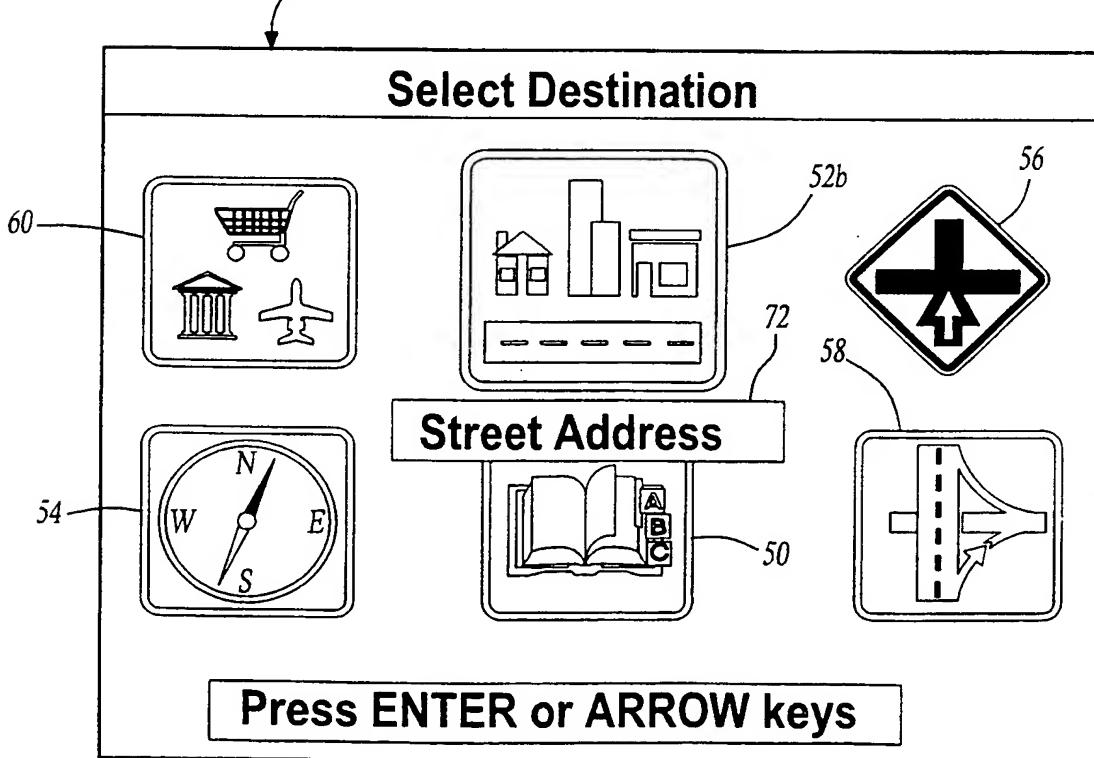


Fig - 2

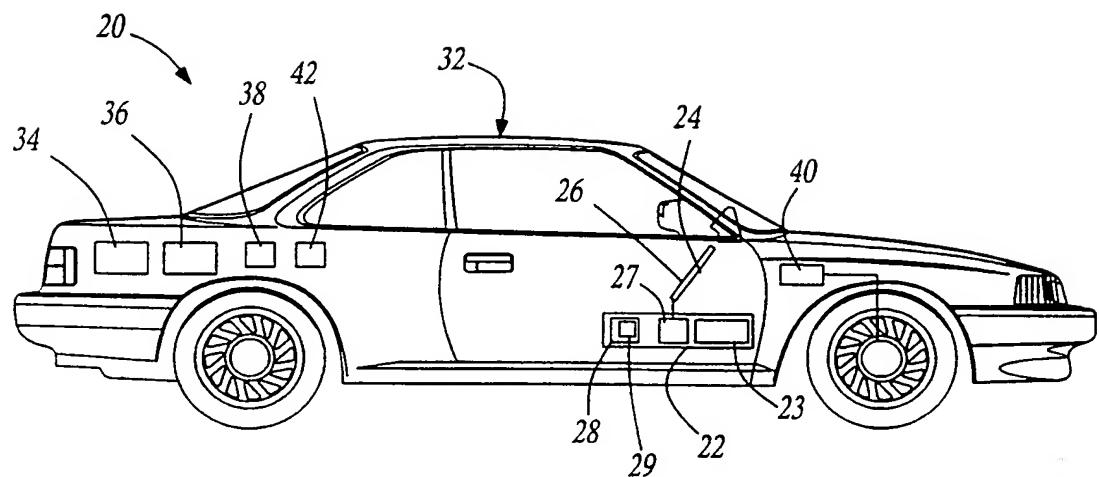


Fig - 1A

3/12

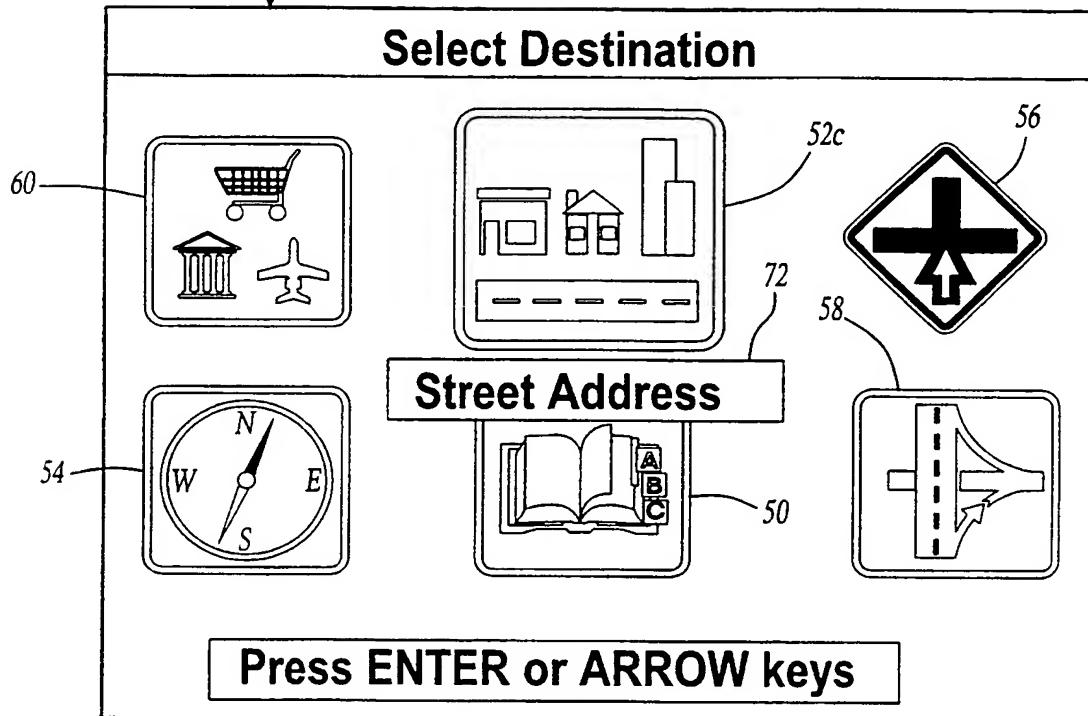


Fig - 3

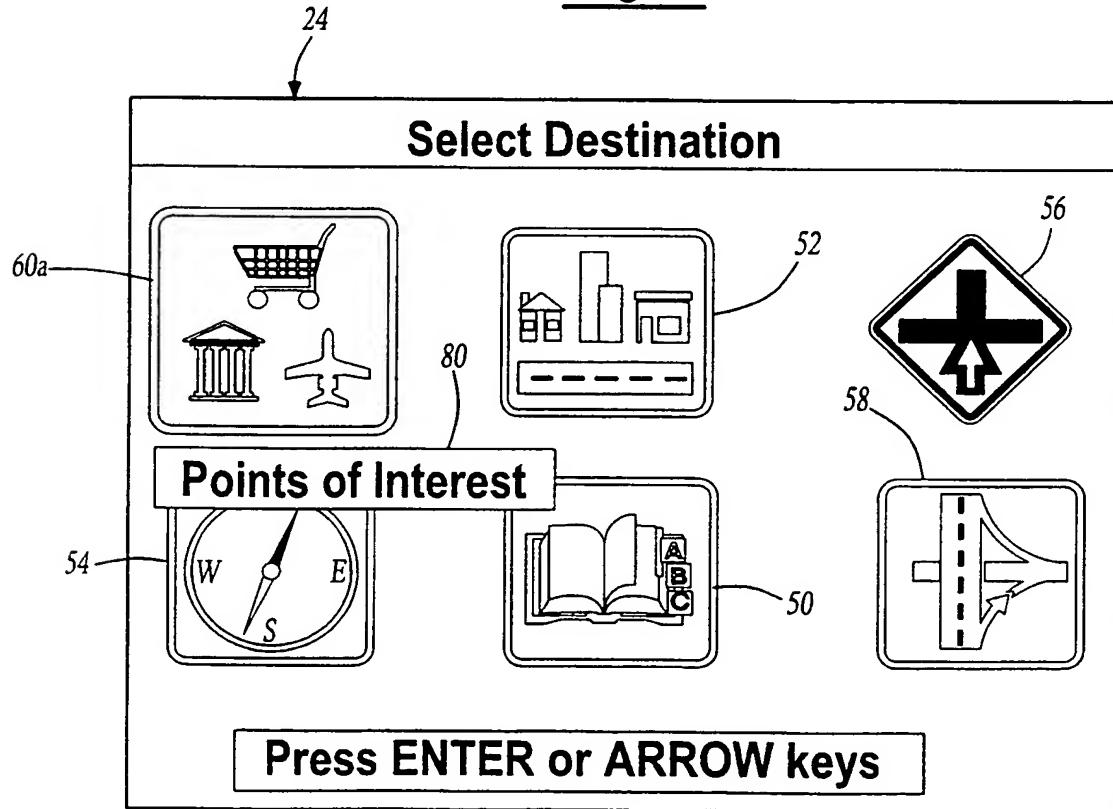


Fig - 4

4/12

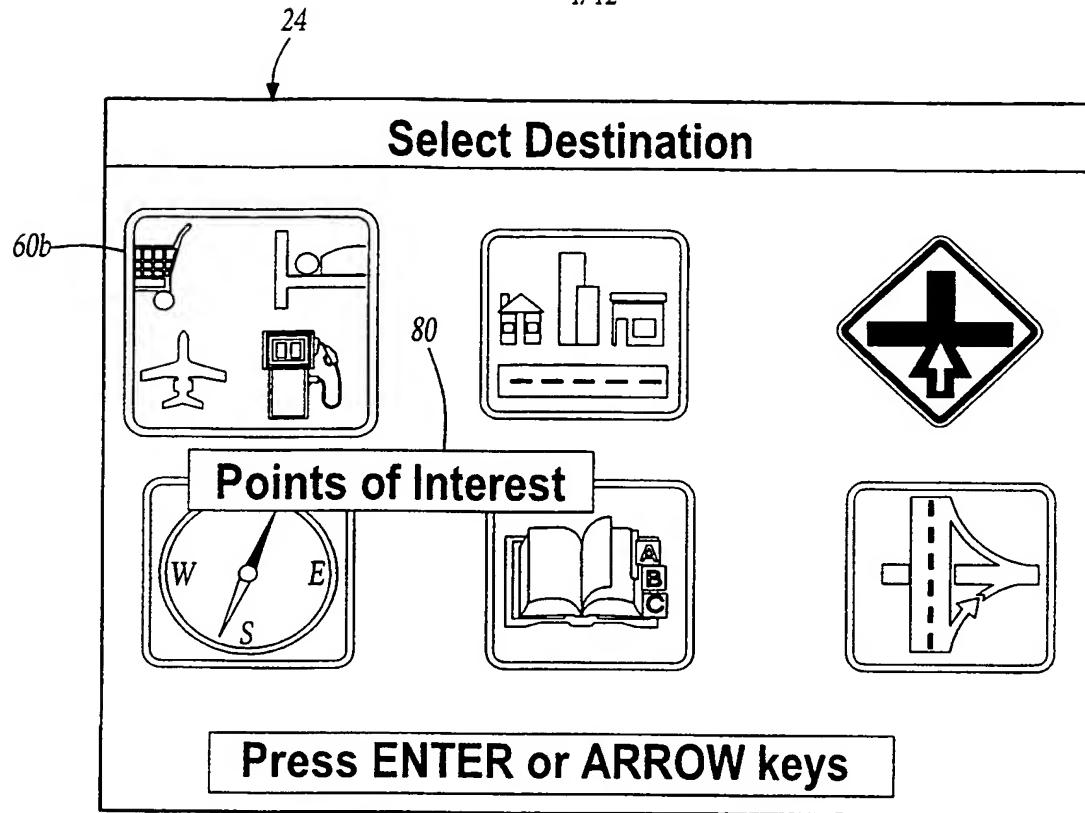


Fig-5

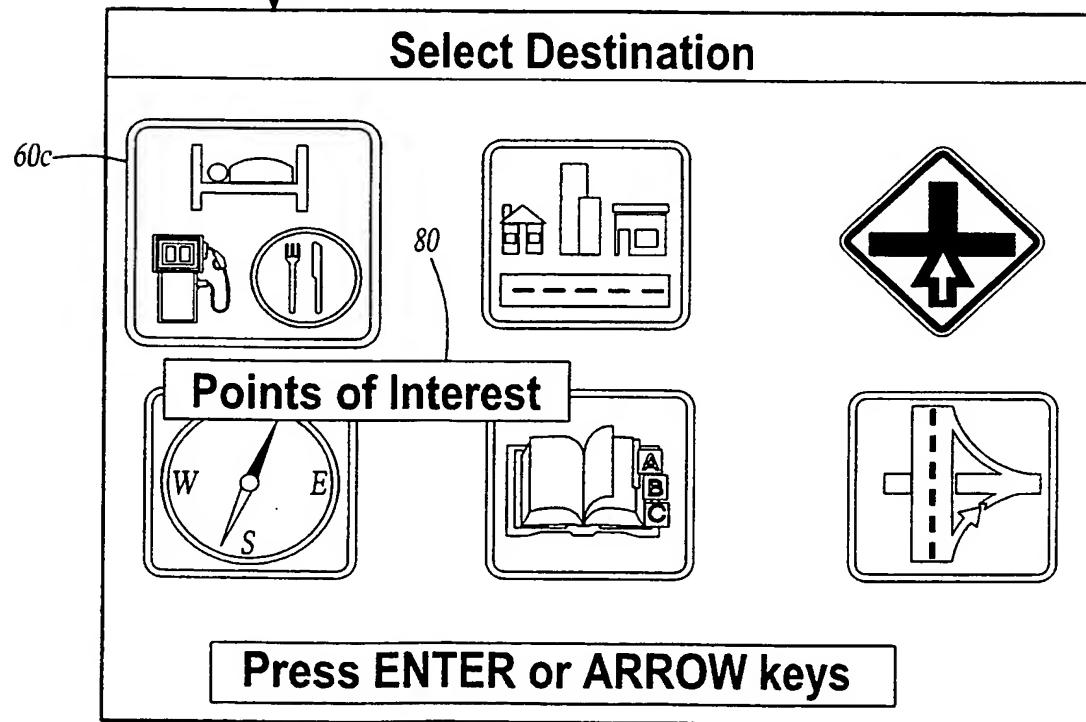


Fig-6

5/12

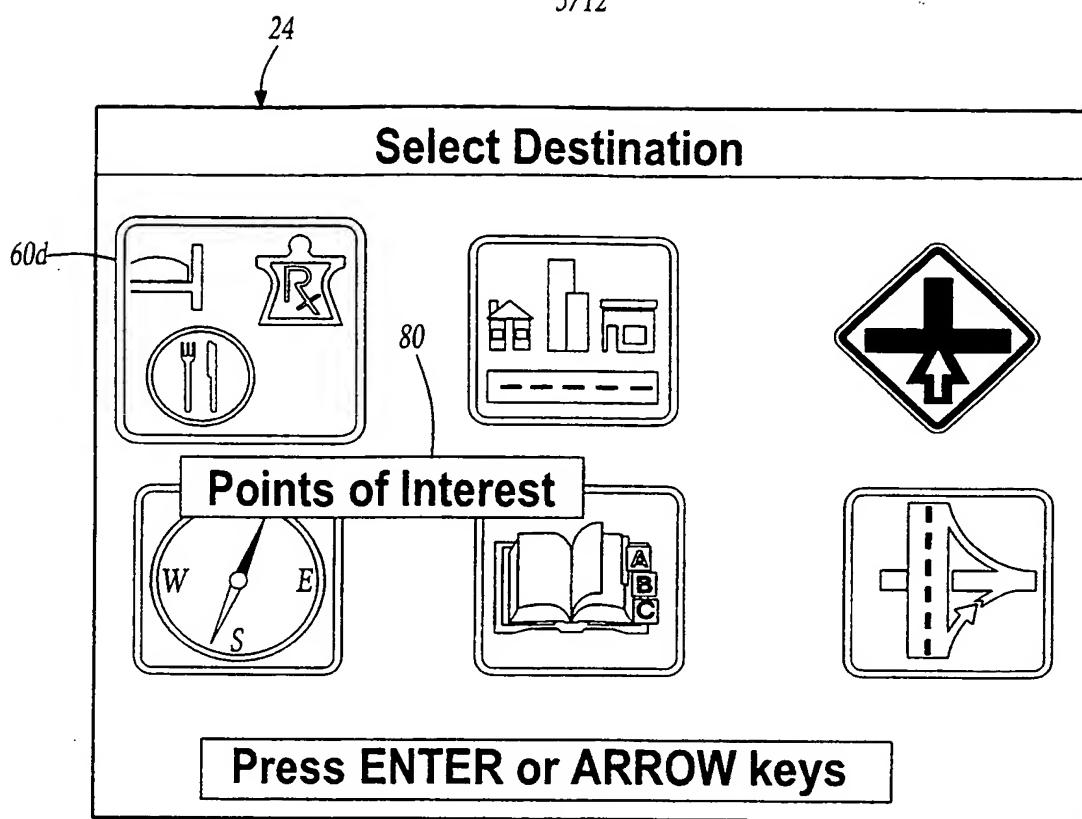


Fig-7

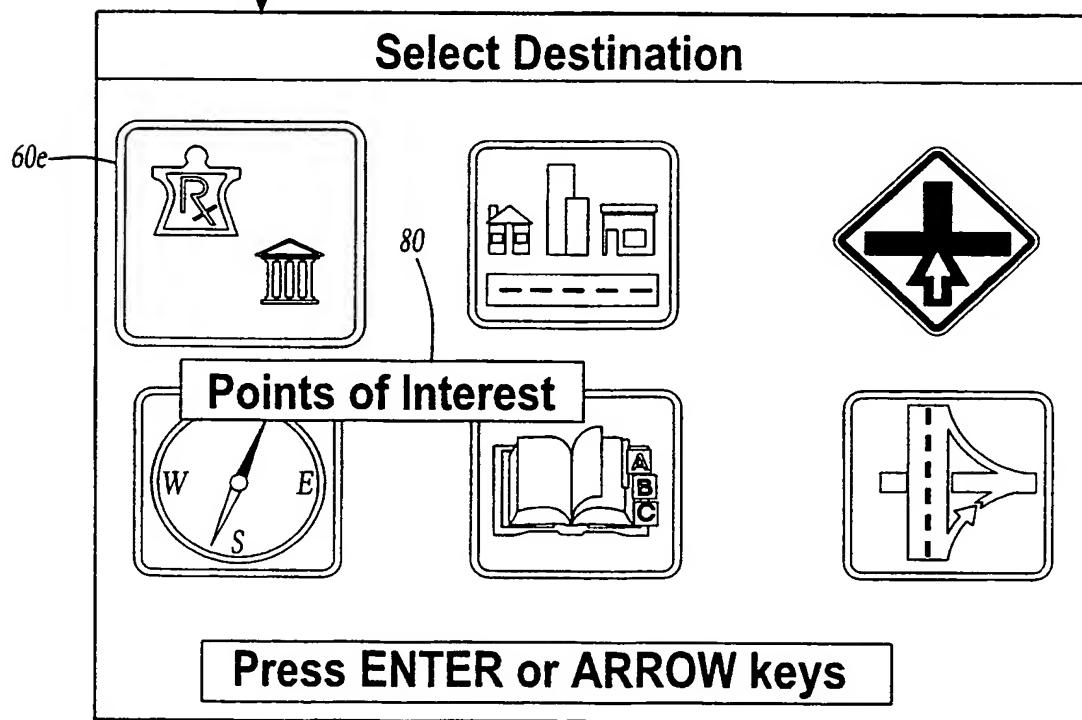


Fig-8

6/12

24

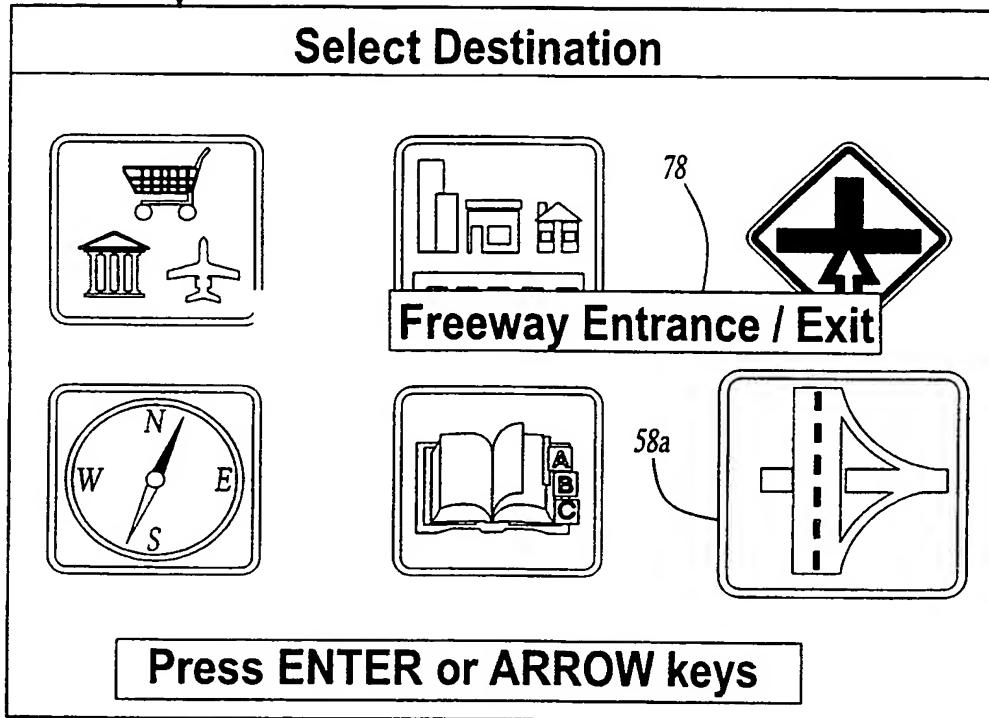


Fig-9

24

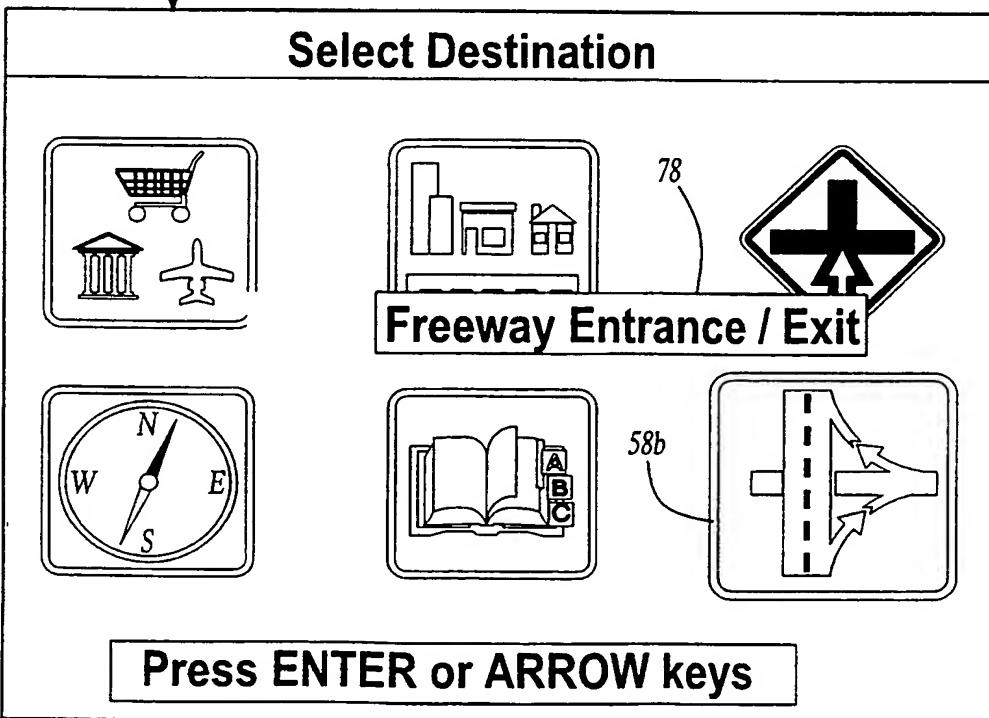
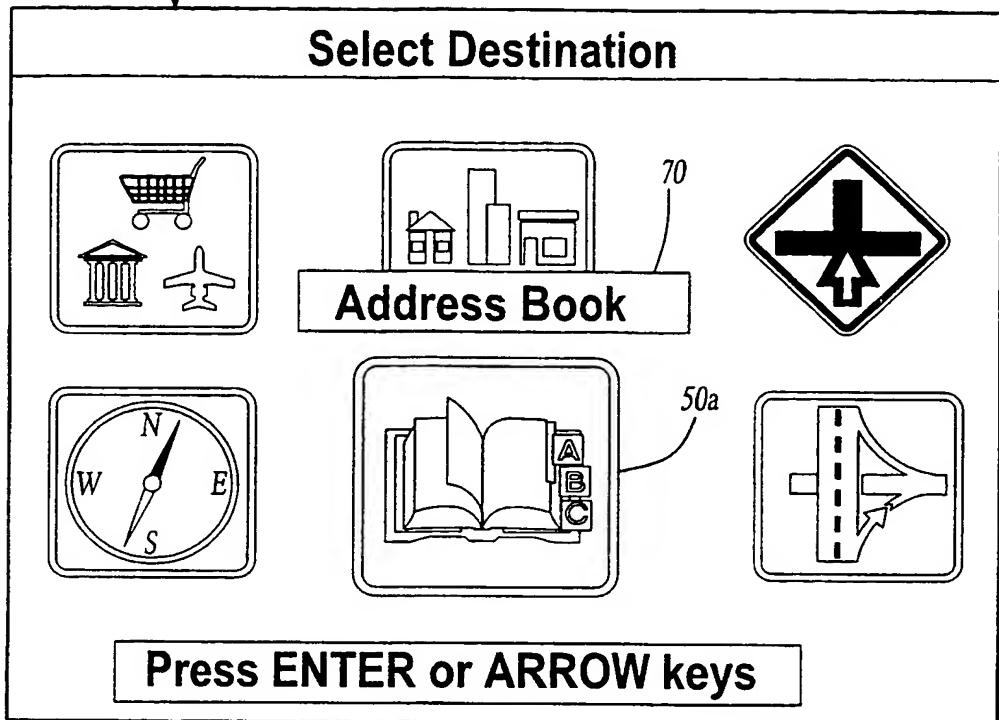


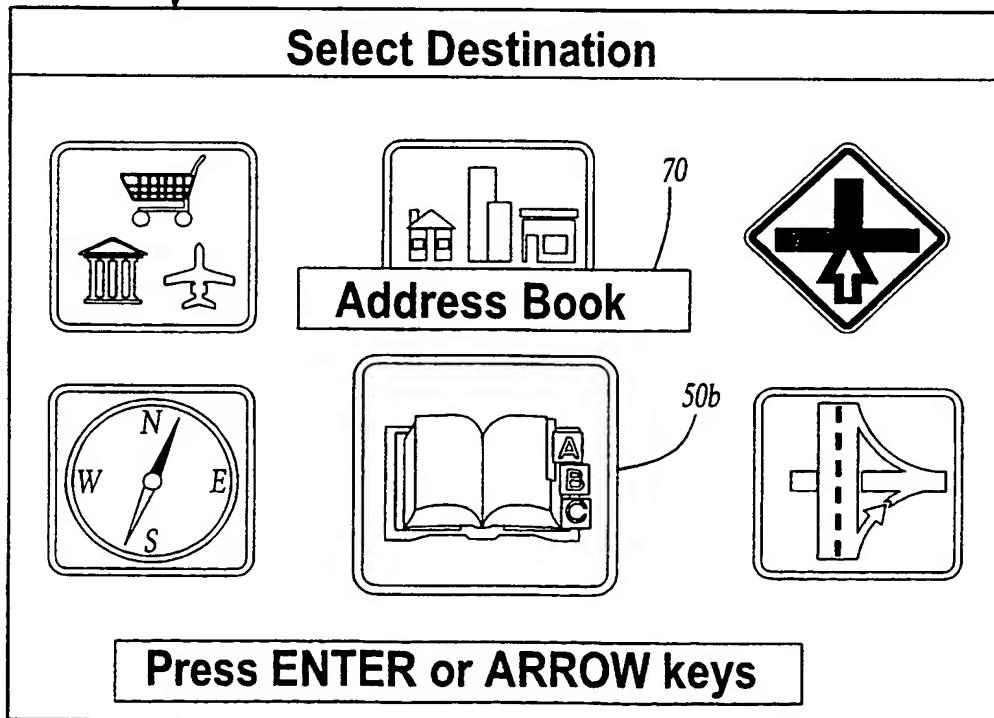
Fig-10

7/12

24

Fig - 11

24

Fig - 12

24

8/12

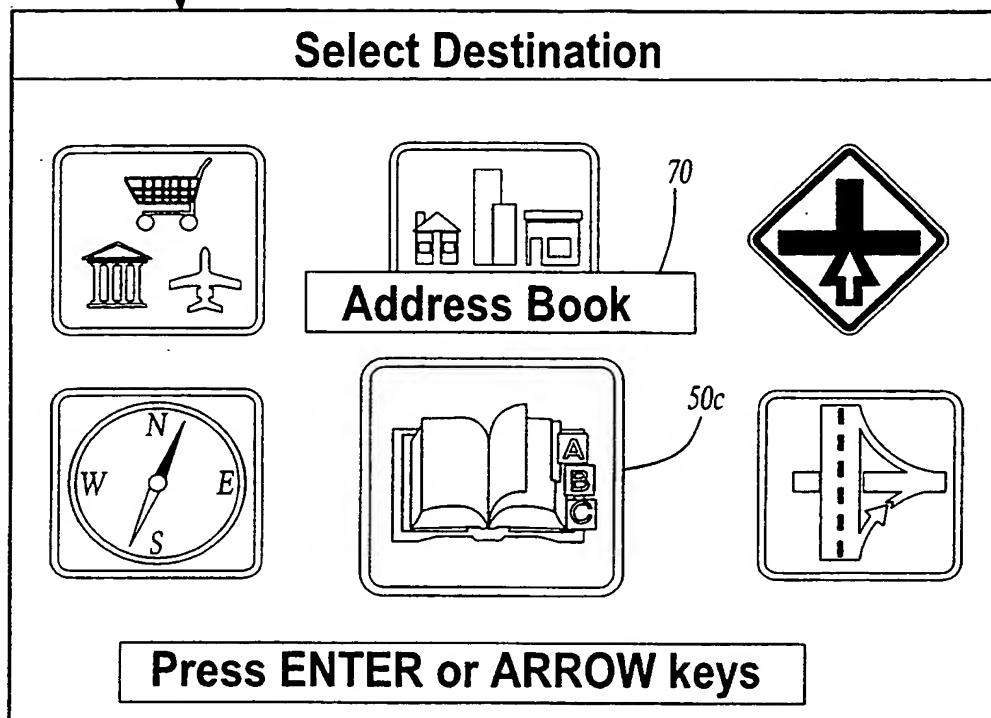


Fig-13

24

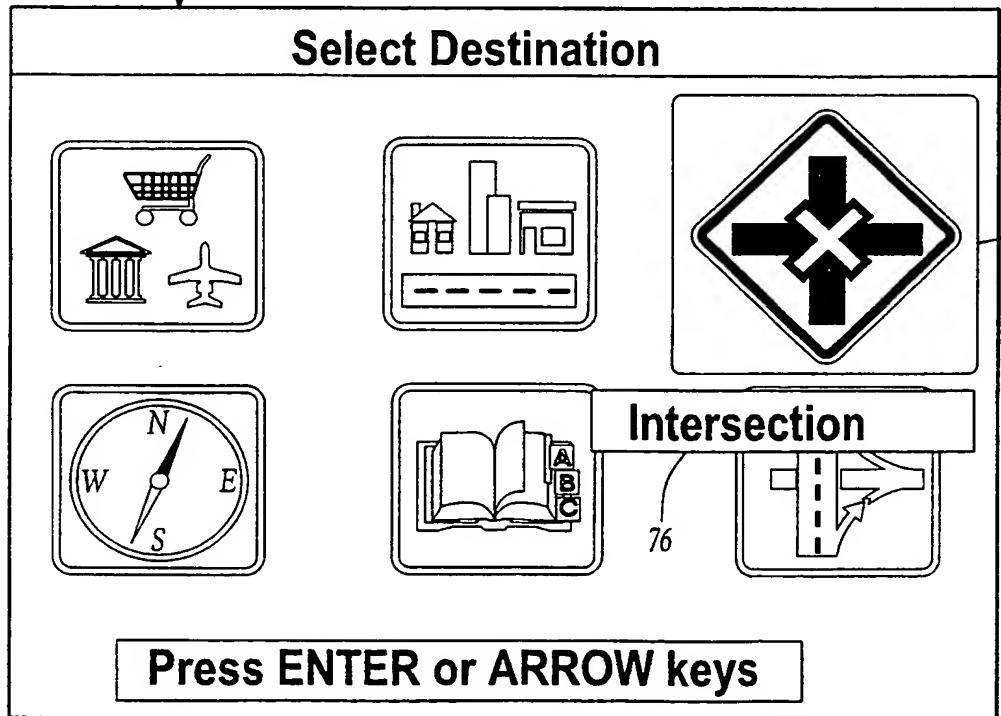


Fig-14

9/12

24

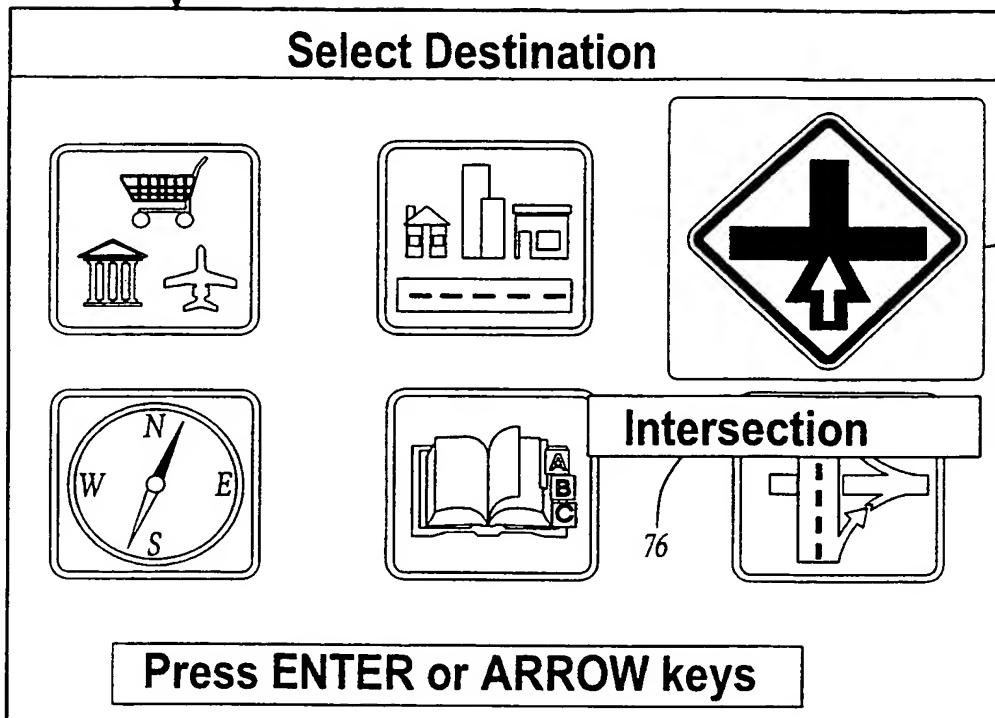


Fig - 15

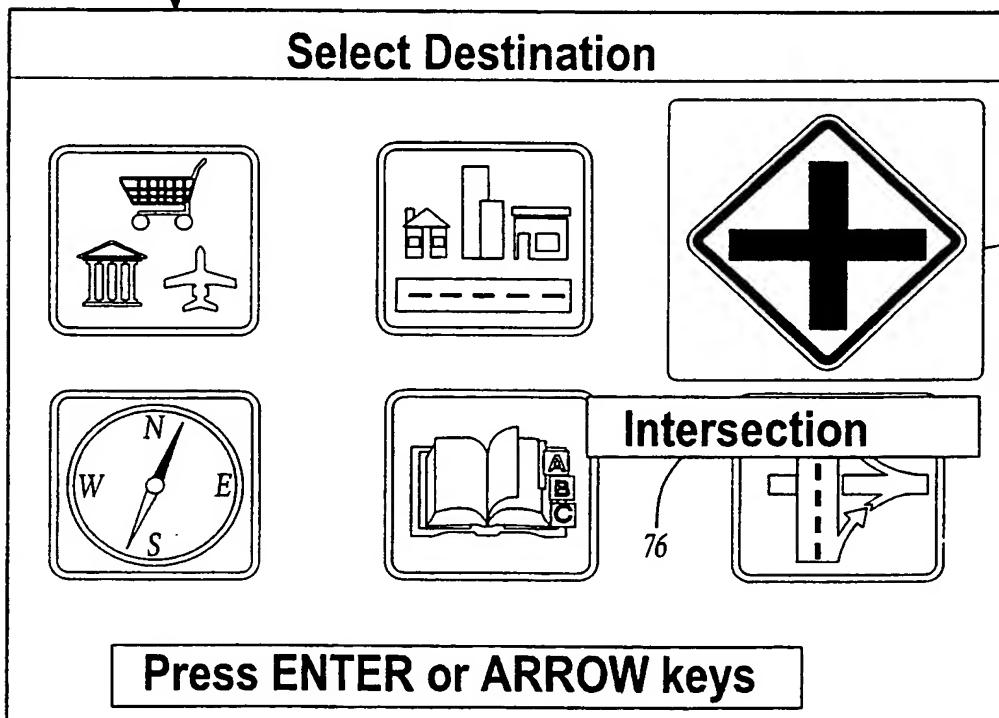
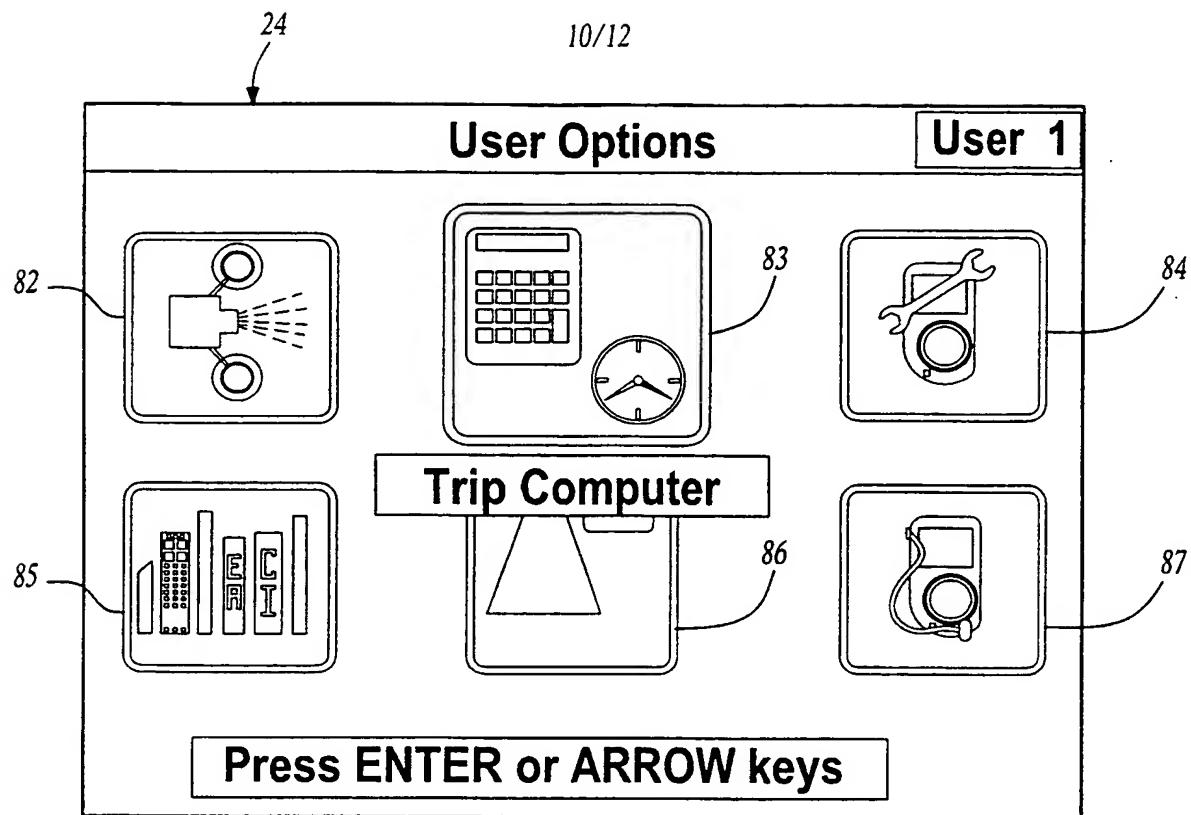
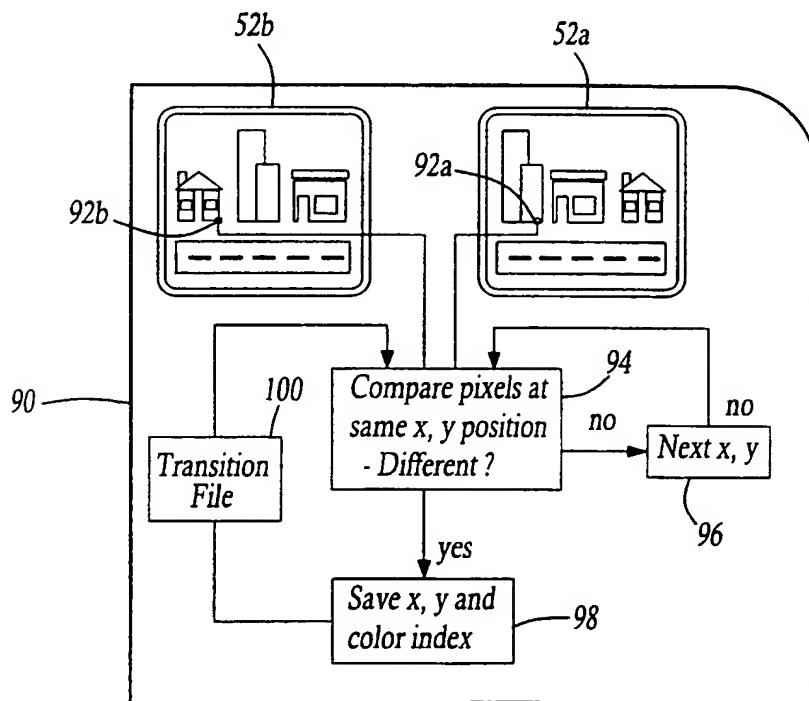


Fig - 16

Fig-17Fig-18

24 11/12

**Select POI Type**

104

106a **Airport**

106b **Amusement Park**

106c **Bank**

106d **Bus Station**

106e **Business Facility**

106f **City Hall**

**N**

Fig - 19

107 24

**Enter City / State**

107

Machesney Park

110

A	B	C
D	E	F
G	H	I

110 110 110

J	K	L
M	N	O
P	Q	R

108

S	T	U
V	W	X
Y	Z	

110

1	2	3
4	5	6
7	8	9
0		

112

**OK**

**N** **Press ENTER to**

Fig - 20

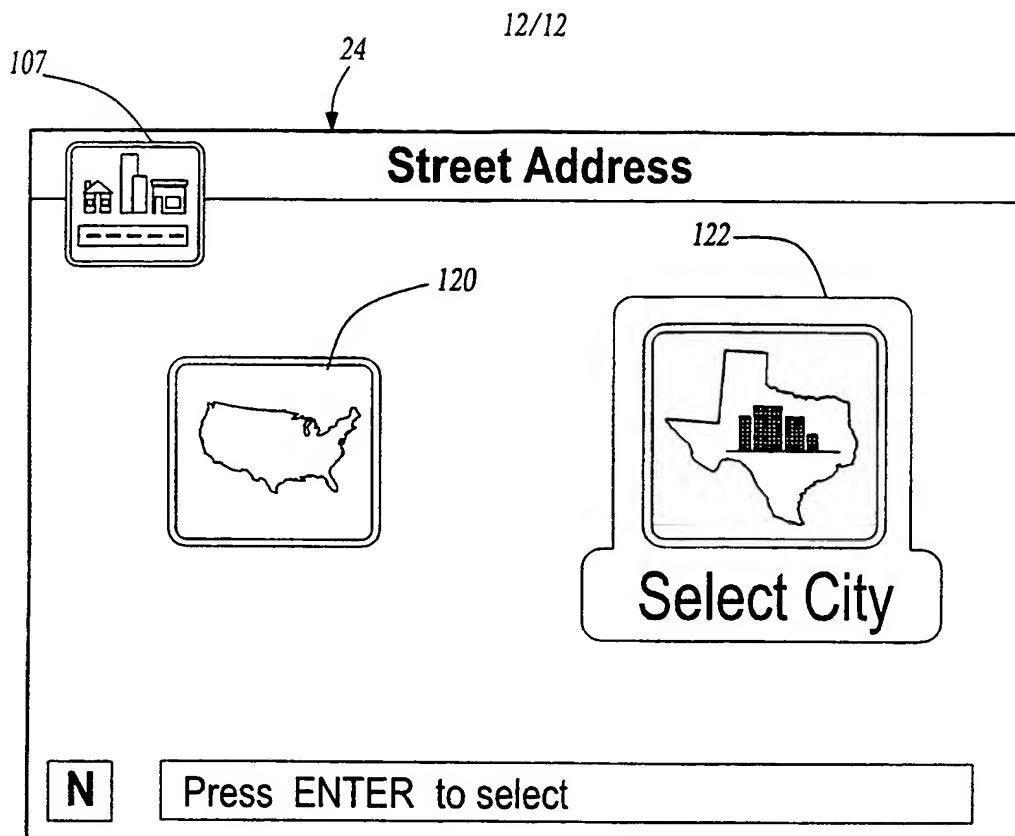


Fig-21

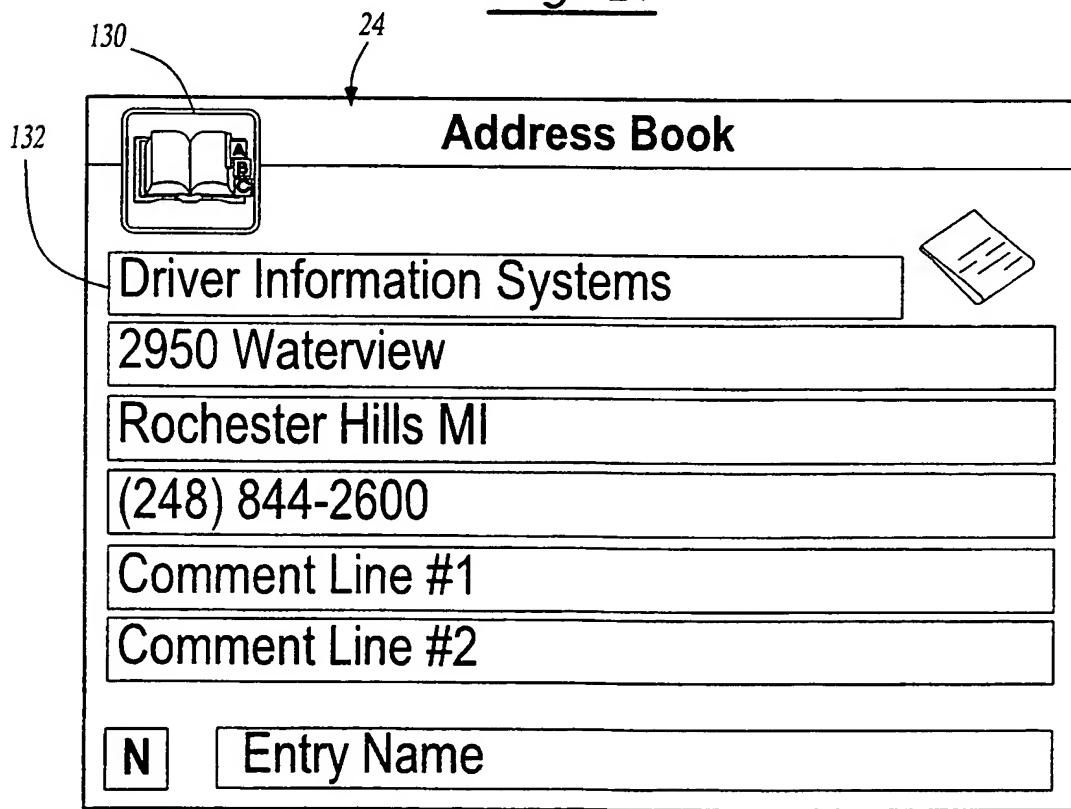


Fig-22

# INTERNATIONAL SEARCH REPORT

Inter. Application No  
PCT/US 99/09779

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G01C21/20

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 G01C G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category <sup>o</sup>	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 829 704 A (XANAVI INFORMATICS CORP ;HITACHI LTD (JP)) 18 March 1998 (1998-03-18) claim 6; figures 1-23	1-3
A	---	4-10
Y	EP 0 478 438 A (SAGEM) 1 April 1992 (1992-04-01) column 6, line 13 - line 30	11
A	---	12-16
Y	US 5 479 602 A (BAECKER RONALD M ET AL) 26 December 1995 (1995-12-26) column 5, line 7 -column 7, line 42	11
A	---	12-16
A	EP 0 704 676 A (PEUGEOT ;CITROEN SA (FR)) 3 April 1996 (1996-04-03) -----	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### <sup>o</sup> Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

28 September 1999

12/10/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl  
Fax: (+31-70) 340-3016

Authorized officer

Crechet, P

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

Intern: [REDACTED] Application No:  
PCT/US99/09779

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 0829704	A	18-03-1998	JP	10089976 A		10-04-1998
EP 0478438	A	01-04-1992	FR	2667423 A		03-04-1992
			AT	131650 T		15-12-1995
			CA	2052370 A		29-03-1992
			DE	69115417 D		25-01-1996
			DE	69115417 T		30-05-1996
			ES	2080924 T		16-02-1996
			JP	4305684 A		28-10-1992
US 5479602	A	26-12-1995	US	5586237 A		17-12-1996
			GB	2241629 A		04-09-1991
EP 0704676	A	03-04-1996	FR	2725067 A		29-03-1996
			DE	69505769 D		10-12-1998
			DE	69505769 T		06-05-1999